by one volume of the gas at the temperature of the observation. The next important observations were those of Fernet, published in 1855 and 1857. He expelled the greater part of the gas of the blood (dog) by passing through it a stream of hydrogen and then submitting it to the action of the air-pump. He then introduced into the apparatus the gas under a given pressure, the absorption coefficient of which he had to determine. He then estimated the amount of gas absorbed, under different pressures, and found in the case of oxygen that the amount absorbed with gradually decreasing increments of pressure was greater than what would have been the case had it been in accordance with Dalton's law of pressures. The oxygen was not then simply dissolved in the blood. Further, Fernet arrived at the conclusion that the greater portion of the oxygen was in a state of combination, whilst a small amount was simply dissolved according to Dalton's law.

It is evident, then, that while the amount of oxygen absorbed varies with the pressure, it does not do so according to Dalton's law. The amount decreases slowly with pressures below atmospheric pressure, and it increases very rapidly with pressures above it. It is when the pressure in the vacuum is as low as one-thirtieth of an atmosphere that the oxygen is given up, and this will be about the pressure of the aqueous vapour in the apparatus at the temperature of the room, when the experiment is made. The view that something in the blood is chemically united to the oxygen is strengthened by the fact that serum does not absorb much more oxygen than water can absorb, so that blood at a temperature of 30° C. would contain only about 2 volumes per cent. of oxygen gas were the latter simply dissolved in the fluid. It can also be shown that defibrinated blood takes up oxygen independently of the pressure, and that the quantity of oxygen taken up by defibrinated blood is about equal to the quantity absorbed by a solution of pure hæmoglobin containing as much of that substance as exists in the same volume of blood.

By similar experiments made with carbonic acid, Fernet determined that the greater portion of it was in a state of loose chemical combination, whilst a small amount was simply dissolved according to the law of pressures. Experiments with blood serum showed similar results as regards carbonic acid, with the difference that the coefficient of absorption for oxygen was much less than with ordinary blood. He therefore concluded that nearly the whole of the carbonic acid was chemically retained in the fluid of the blood, whilst nearly the whole of the oxygen was combined with the red blood corpuscles. He then proceeded to investigate whether or not the three principal salts of the blood, carbonate of soda, phosphate of soda, and chloride of sodium, in any way influenced the absorption coefficient of carbonic acid. He found (1) that the addition of these salts to distilled water in the proportion in which they exist in the serum slightly diminishes the absorption coefficient; (2) that chloride of sodium has no influence on the absorption coefficient; and (3) that carbonic acid combines with the carbonate and phosphate of soda.

In the same year (1855) Lothar Meyer published the results of a series of researches of the same nature. Under the direction of Bunsen, the blood was diluted with ten times its bulk of water, and the gases were collected by boiling the liquid *in vacuo* at a very gentle heat; a certain amount of gas was thus obtained. He also found that blood absorbs a much larger quantity of carbonic acid than pure water at the same temperature, and stated that when blood was exposed to oxygen at various pressures the quantity of that gas taken up might be regarded as consisting of two portions, one following Dalton's law and the other independent of it.

Further researches of a similar kind have been carried out by Setschenow, Ludwig, Alexander Schmidt, Bert, Pflüger, and others, and ingenious methods of collecting and of analyzing the gases have been devised. To Prof. Pflüger and his pupils, in particular, are we indebted for the most complete series of gas analyses on record. The result has been to enable us to give the average composition of the gases of the blood as follows. From 100 volumes of dog's blood there may be obtained—

	Oxygen.	Carbonic Acid.	Nitrogen.
Arterial	18·4 to 22·6, mean 20	30 to 40	1·8 to 2
Venous	Mean 11·9	43 to 48	1·8 to 2

the gases being measured at 0° C. and 760 mm. pressure. The venous blood of many organs may contain less than 11·9 per cent. of carbonic acid, and the blood of asphyxia may contain as little as 1 volume per cent. It is clear, then, that the gases of the blood do not exist in a state of simple solution, but that they are largely combined with certain constituents of the blood. Take, for example, the case of oxygen. Berzelius showed long ago that 100 volumes of water will absorb, at a given temperature and pressure, 2·9 volumes of oxygen; while, in the same circumstances, 100 volumes of serum will absorb 3·1 volumes, and 100 volumes of blood will absorb 9·6 volumes. Something in the blood must have the power of taking up a large amount of oxygen.

(*To be continued.*)

THE BATH MEETING OF THE BRITISH ASSOCIATION.

THE arrangements for the Bath meeting of the British Association are now practically completed. The Reception Room, adjoining the Assembly Rooms, will be opened on Monday, September 3, at 1 p.m., and on each succeeding week-day till Thursday, September 13, at 8 a.m. precisely; on Sunday, September 9, from 8 to 10 a.m., and from 3 to 6 p.m. In this building will be the offices of the General and Local Secretaries and Treasurers, a post office, telegraph office, telephone, ticket office, lodgings, inquiry, excursion, and lost property offices, and offices for the supply of all official papers and programmes. There will also be lavatories, cloak-rooms, &c., &c. The Council of the Association will meet in the Guildhall.

In the Reception Room there will be offices for supplying information regarding the proceedings of the meeting. The tickets contain a map of Bath, and particulars as to the rooms appointed for the Sectional and other meetings. A list of lodgings, or apartments, with prices, &c., and also information concerning hotels, and other similar matters, will be furnished by the Lodgings Clerk between the hours of 9 a.m. and 6 p.m. daily, at No. 13 Old Bond Street, up to 1 p.m. on Monday, September 3, and after that time at the Reception Room between the same hours daily.

The places of meeting, &c., will be in the Assembly Rooms, the Drill Hall, and the Guildhall. The Secretaries of Sections will be lodged at the White Lion Hotel. The following are the Section Rooms:—A, Mathematics, St. James's Hall; B, Chemistry, Friends' Meeting House; C, Geology, Mineral Water Hospital; D, Biology, Mineral Water Hospital; E, Geography, Guildhall; F, Statistics, Christ Church Hall; G, Mechanics, Masonic Hall; H, Anthropology, Grammar School; Sub-Sections C and D, Blue-Coat School.

By the courtesy and liberality of the Directors of the Western Counties and South Wales Telephone Company, the whole of the Section Rooms will be telephonically connected with the Reception Room, and, through the Telephone Exchange, with all important places in the neighbourhood, free of any expense to the Local Executive Committee, or members and associates, for the meeting.

The first general meeting will be held on Wednesday, September 5, at 8 p.m. precisely, in the Drill Hall, when Sir H. E. Roscoe, M.P., F.R.S., will resign the chair, and Sir Frederick Bramwell, F.R.S., President-Elect, will assume the Presidency, and deliver an address. According to the *Times*, Sir Frederick is sure to deal pretty largely with progress in the department with which his name is so eminently connected. With regard to the addresses of the Presidents of Sections the *Times* makes the following statement:—In Section A (Mathematics and Physics), Prof. Fitzgerald is President, and the subject of his address will probably be connected with Clerk-Maxwell's theory that electric and magnetic forces are produced by the same medium that propagates light, and some recent experimental proofs of that theory. In Section B (Chemistry), Prof. W. A. Tilden, of Birmingham, is President, and his address will be concerned with the history of the teaching of chemistry practically, and will review the existing provision for efficient teaching of chemistry in this country. This will be followed by some discussion of the methods actually used or proposed for teaching chemistry either as a constituent part of a liberal education or for technical purposes, together with an endeavour to trace the causes of the unproductiveness of the English schools in respect to advanced studies, and especially in regard to the results of original research. Prof. Boyd Dawkins is President of Section C (Geology). Among other points which he is likely to discuss will be the following:—That in the history of life on the earth the more complex forms have changed more swiftly than the simpler, because they are more susceptible to changes in their environment. That in the Tertiary age the highest of all, or the placental mammals, are the only forms which have changed with sufficient swiftness to mark the subdivisions of the Tertiary period. They alone are *en pleine évolution*. The borderland between geology and history will be discussed, and the present series of events shown to belong to the Tertiary period. The place of man in the geological record will be considered (pre-glacial). The impossibility of fixing historic dates for geological events will also be discussed. Outside the written record a sequence of events can alone be made out, in which we are ignorant of the length of the intervals. In Section D (Biology), of which Mr. Thiselton Dyer, Director of Kew Gardens, is President, no doubt we may expect some of those discussions on subjects of general biological interest which have been so marked a feature of the Section since Prof. Ray Lankester was its President at Southport. Colonel Sir Charles Wilson presides over Section E (Geography), and his address will deal largely with the commercial aspects of geography. In Section F (Economics), of which Lord Bramwell is President, the Presidential address is likely to be brief, and will deal with the general principles of political economy, and with socialism in particular. Mr. W. H. Preece, of the Telegraph Department, will preside over Section G (Mechanical Science). In his address he will pass under review the various practical applications of electricity, with the introduction of nearly all of which Mr. Preece has been more or less associated. He will also probably say something about the present views of the theory of electricity, about which practical electricians and pure physicists are at entire variance. Finally, in Section H (Anthropology), the address of the President, General Pitt-Rivers, is, like Lord Bramwell's, likely to be short.

Discourses will be delivered in the Drill Hall—on Friday evening, September 7, by Prof W. E. Ayrton, F.R.S., on "The Electrical Transmission of power"; on Saturday Evening, September 8 (to "the opertive classes"), by Sir John Lubbock, M.P., F.R.S., on "The Customs and Ideas of Savage Races"; on Monday evening, September 10, by Prof. T. G. Bonney, F.R.S., on "The Foundation Stones of the Earth's Crust."

The Mayor of Bath invites the members and associates to a *conversazione* in the Assembly Rooms on Thursday, September 6, at 8.30 p.m. The Chairman and members of the Local Executive Committee invite the members and associates to a *conversazione* at the Assembly Rooms, on Tuesday, September 11, at 8.30 p.m. On this occasion the Bath Microscopical Society, assisted by the Bristol Microscopical Society, have arranged for a display of objects in the various departments of natural history, &c. No special cards of invitation will be issued to these *conversaziones*, but all members and associates will be admitted on presentation of their tickets.

The concluding general meeting will be held on Wednesday, the 12th of September, at 2.30 p.m.

On Wednesday and Thursday, the 5th and 6th of September, there will be an exhibition of fruits, flowers, &c., in the Sydney Gardens; to this exhibition all members and associates will be admitted on presentation of their tickets. On the 12th and 13th of September there will be a horse show in Bath; but on this occasion the members and associates will have no special advantages.

The following are the proposed excursions, arrangements for which are in active progress:—

Saturday, September 8.—Stanton Bury, Stanton Drew, Maes Knoll: Bannerdown, Sodbury Camp, Dyrham, Lansdown: Box Quarries, Corsham, Lacock Abbey: Bradford, Farleigh Castle, Wraxall: Cirencester, Museum and College: Tytherington and Thornbury: Swindon, G.W. Works: Berkeley Castle: Wells, *viâ* Maesbury and Shepton Mallet, Ebbor, Wookey Hole: Barry Docks and Cardiff.

Thursday, September 13.—Stonehenge, Salisbury, Wilton: Silbury, Avebury, Bowood, Wansdyke, Beckhampton: Stourton, Pen Pits, White Sheet, Longleat: Frome Valley, Nunney Whateley: Maesbury, Wells, Glastonbury, Street: Sandford and Banwell, Churchill, Dolbury, Rowberrow, Burrington, the two Charterhouses, Mendip Gorge, Cheddar Cliffs: Severn Tunnel, Chepstow, Tintern, Wyndcliffe: Radstock, Wellow, Littleton.

SOCIETIES AND ACADEMIES.

LONDON.

Entomological Society, August 1.—Dr. D. Sharp, President, in the chair.—Mr. F. D. Godman, F.R.S., exhibited a large number of species of Lepidoptera and Diptera recently collected for him in Mexico by Mr. Herbert Smith.—Mr. White exhibited parasites bred from *Bombyx neustria*, and a living example of *Heterodes guyoni*, found at Dartford, and believed to have been introduced with Esparto grass from Tunis.—Mr. Enock exhibited a stem of barley, showing the appearance of the plant under an attack of Hessian fly.—Mr. Stevens exhibited a number of galls collected at Byfleet in July last; also a specimen of *Coleophora solitariella*, with ichneumons bred from it.—Mr. E. Saunders exhibited a specimen of *Catephia alchymista*, captured at St. Leonards, in June last. He also exhibited specimens of a rare ant (*Anochetus ghiliani*), taken at Tangier by Mr. G. Lewis. One of these he had submitted to Dr. Emery, of Bologna, who thought that, although ocelli were present, the specimen was probably intermediate between a worker and a female, and that possibly the true female did not exist.—Mr. Pascoe exhibited a number of species of Coleoptera recently collected in Germany and the Jura Mountains, and read a note correcting the synonymy of certain species of *Brachycerus* recently described by him in the Transactions of the Society. He stated that the corrections had been suggested by MM. Peringuey and Aurivillius.—Prof. Westwood communicated a paper entitled "A List of the Diurnal Lepidoptera collected in Northern Celebes by Dr. Sydney Hickson, with descriptions of new species."

EDINBURGH.

Royal Society, July 16.—Rev. Prof. Flint, Vice-President, in the chair.—Dr. Traquair read an obituary notice of Mr. Robert Gray, Vice-President.—A paper by Prof. C. G. Knott, Tokio University, on some relations between magnetism and twist in iron and nickel, was submitted.—Mr. R. Kidston communicated a paper on the fossil plants in the Ravenhead collection in the Liverpool Museum.—Prof. Crum Brown submitted an investigation by Mr. Alex. Johnstone on the action of carbonic acid water on olivine.—In a paper discussing the question, Is Talbot's law true for very short stimuli? Dr. G. N. Stewart, Owen's College, describes experiments designed to test whether it is possible to make the luminous stimuli so short that the separate effects cannot be summed. He was able, by means of a rotating mirror, to reduce the length of each stimulus to something like 1/8,000,000 sec. Up to this limit he could detect no variation from the law.—Another paper by Dr. Stewart, on some colour phenomena observed with intermittent stimulation with white light, was communicated. When light of moderate intensity is used, and the rate of stimulation gradually increased, the colour is seen to change regularly in a manner which can be explained on the assumption that the curves representing the course of the excitation in the three hypothetical fibre-groups run in such a way that with a certain length of stimulation time the violet fibres are proportionally more stimulated than the others; with a shorter time of stimulation the green fibres are more stimulated; with a still shorter time, the red.—Dr. H. R. Mill, Scottish Marine Station, discussed the specific gravity of the water in the Firth of Forth and the Clyde sea-area.—Dr. J. Macdonald Brown read a paper on arrested twin development.—The Chairman made some remarks in closing the session.

PARIS.

Academy of Sciences, July 30.—M. Janssen, President, in the chair.—On the relations of atmospheric nitrogen to vegetable soil, by M. Th. Schlœsing. The conclusion already arrived at from previous researches (see *Comptes rendus* for March 19 and 26, 1888) is fully confirmed by the results of the subsequent series of experiments here described. Whether exposed to renewed contact with the air, or kept in closed vessels with a confined but oxygenated atmosphere, the soil with which the experiments have been made has in no case fixed any appreciable quantity of gaseous nitrogen. The author supplements this communication with some remarks on the quantitative analysis of the carbon and nitrogen in vegetable earths. The